FUTURE COMBAT SYSTEMS SPINOUT 1 TECHNICAL FIELD TEST – ESTABLISHING AND IMPLEMENTING MODELS AND SIMULATIONS SYSTEM OF SYSTEMS VERIFICATION, VALIDATION AND ACCREDITATION PRACTICES, METHODOLOGIES AND PROCEDURES[1]

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Abstract

As our Armed Forces transform, assisted by the Brigade Combat Team (BCT) Modernization effort, the use of Models and Simulations (M&S) becomes more crucial in supporting major Department of Defense and Congressional decisions, given limited resources and strategic constraints. The Army's program leading the transformation from 2003 to 2009 was Future Combat Systems (FCS) with 14 systems + The Soldier + their network. For Phase 1 (IP1) Spinout 1 (SO1) Technical Field Test (TFT), three live systems (i.e., Non-Line of Sight-Launch System (NLOS-LS), Unattended Ground Sensor (UGS), and B-Kits) participated and were tested in 2008 via a slice of the Current Force (CF) BCT structure. To ensure realistic operational context, a M&S System-of-Systems (SoS) level federation was developed providing virtual and constructive simulation capabilities that enabled holistic testing with complex integration among all entities in a distributed Live-Virtual-Constructive (LVC) environment. This included interfaces to live entities and instrumentation via tactical messages, and constructive representation of platforms, vehicles, and terrain. The M&S federation also provided test control, data collection, and live range interactions.

The foundation for the Accreditation process of the SO1 TFT federation was the Verification, Validation and Accreditation (VV&A) Overlay to the DoD High Level Architecture (HLA) Federation Development and Execution Process (FEDEP). A three-phased V&V process was used that provided component level V&V, initial Federation V&V via multiple M&S integration events, with the final events performed in the FCS Mobile Node. The SO1 TFT M&S Federation developed by the Cross Command Collaboration Effort (3CE) was part of the "common SO1 M&S/tools federation solution" for all SO1 test events.

The Acceptability Criteria were developed via an iterative process, involving the Test Manager and all VV&A Teams, that began with identifying Assessment Objectives associated with M&S for IP1 SO1 TFT that can be traced back to the FCS requirements/capabilities and TRADOC Operational and Organizational documentation. Once the Acceptability Criteria and Metrics (ACM), 9 and 25 respectively, were approved several traceability analyses were conducted with ACMs thoroughly examining the 213 M&S requirements and M&S intended uses developed by the Test Manager. The results helped to form a solid foundation for accreditation assessment providing focus in building the body of V&V evidence and the accreditation methodology.

To verify M&S requirements and objectives the Accreditation Team worked closely with V&V Teams, Test Manager, 3CE and all M&S component developers during all Integration Events to understand functions and capabilities of TFT M&S Federation and each individual component, data, and support tools. This invaluable experience provided insight on data collection and format, terminologies used, and expectations.

Accreditation assessments were conducted to support preliminary and final Test Readiness Reviews (TRR). The Accreditation Assessment rating used was a 5-point satisfaction-risk table developed by Accreditation Team. By the final TRR all requirements were verified, all results validated, and all accreditation metrics and criteria were met successfully demonstrating an Unconditional Accreditation of the SO-1 TFT M&S Federation in support of the SO1 TFT Runs for Record.

Keywords: Models, Simulations, M&S, Verification, Validation, Accreditation, VV&A, Federation, System of Systems, LVC, Live Virtual, Constructive

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14. ABSTRACT

As our Armed Forces transform, assisted by the Brigade Combat Team (BCT) Modernization effort, the use of Models and Simulations (M&S) becomes more crucial in supporting major Department of Defense and Congressional decisions, given limited resources and strategic constraints. The Army's program leading the transformation from 2003 to 2009 was Future Combat Systems (FCS) with 14 systems + The Soldier + their network. For Phase 1 (IP1) Spinout 1 (SO1) Technical Field Test (TFT), three live systems (i.e., Non-Line of Sight-Launch System (NLOS-LS), Unattended Ground Sensor (UGS), and B-Kits) participated and were tested in 2008 via a slice of the Current Force (CF) BCT structure. To ensure realistic operational context, a M&S System-of-Systems (SoS) level federation was developed providing virtual and constructive simulation capabilities that enabled holistic testing with complex integration among all entities in a distributed Live-Virtual-Constructive (LVC) environment. This included interfaces to live entities and instrumentation via tactical messages, and constructive representation of platforms, vehicles, and terrain. The M&S federation also provided test control, data collection, and live range interactions. The foundation for the Accreditation process of the SO1 TFT federation was the Verification, Validation and Accreditation (VV&A) Overlay to the DoD High Level Architecture (HLA) Federation Development and Execution Process (FEDEP). A three-phased V&V process was used that provided component level V&V, initial Federation V&V via multiple M&S integration events, with the final events performed in the FCS Mobile Node. The SO1 TFT M&S Federation developed by the Cross Command Collaboration Effort (3CE) was part of the "common SO1 M&S/tools federation solution" for all SO1 test events. The Acceptability Criteria were developed via an iterative process, involving the Test Manager and all VV&A Teams, that began with identifying Assessment Objectives associated with M&S for IP1 SO1 TFT that can be traced back to the FCS requirements/capabilities and TRADOC Operational and Organizational documentation. Once the Acceptability Criteria and Metrics (ACM), 9 and 25 respectively, were approved several traceability analyses were conducted with ACMs thoroughly examining the 213 M&S requirements and M&S intended uses developed by the Test Manager. The results helped to form a solid foundation for accreditation assessment providing focus in building the body of V&V evidence and the accreditation methodology.

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1. Introduction and Background

As our Armed Forces transform, assisted by the Brigade Combat Team (BCT) Modernization effort, the use of Models and Simulations (M&S) becomes more crucial in supporting major Department of Defense and Congressional decisions, given limited resources and strategic constraints.

The U.S. Army's program leading the transformation from 2003 to 2009 was Future Combat Systems (FCS) with 14 systems + The Soldier + the supporting network. For Phase 1 (IP1) Spinout 1 (SO1) Technical Field Test (TFT), three live systems (i.e., Non-Line of Sight-Launch System (NLOS-LS), Unattended Ground Sensor (UGS), and B-Kits) participated and were tested in 2008 via a slice of the Current Force (CF) BCT structure. To ensure realistic operational context, an M&S System-of-Systems (SoS) level federation was developed to provide virtual and constructive simulation capabilities that enabled holistic testing with complex integration among all entities in a distributed Live-Virtual-Constructive (LVC) environment. The federation included: interfaces to live entities and instrumentation via tactical messages; constructive representations of platforms, vehicles, and terrain; test control, data collection, and live range interactions.

2. Constraints

When Army Leadership decided that the M&S Federation supporting the SO1 TFT required Accreditation, there were many constraints regarding the SO1 test events already in place. Although the Accreditation Team was not involved from the very beginning, the team was able to work within the "constraints" framework and make a positive impact. Some of the "constraints" in place were:

1. VV&A roles and responsibilities

A different organization was responsible for each test event; therefore, a different organization was responsible for accrediting the M&S that supported a given test event.

2. Essential FCS documents (e.g., plans and requirements documents)

The initial draft of V&V Plan was started before the Accreditation Team came on board.

3. Planning and Execution Test Schedule

Less than one year was scheduled to conduct the SO1 TFT Accreditation Assessment. The Accreditation Team's involvement began after everyone else.

4. There were 307 Test Requirements generated by Test Manager, the Lead System Integrator (LSI), the contractor that executed the SO1 TFT event

Once the Acceptability Criteria (AC) and Metrics (ACMs), were finalized and approved, they were analyzed against the 307 Test Requirements[2] . The Accreditation Team identified 94 as being necessary for the test event but outside the VV&A scope leaving 213 identified as M&S Requirements.

5. M&S Federation, M&S support tools, and data integrated by the Cross Command Collaborative Effort (3CE)

The 3CE Group was responsible for defining "the M&S Common Solution" for all the SO1 Events (i.e., TFT, FDT&E, LUT and Train-up). The 3CE addressed M&S issues and requirements, defined the M&S architecture, and performed M&S integration and testing.

3. Accreditation's Team Approach Used to Accredit the M&S Federation

The approach followed was the Federation Development and Execution Process (FEDEP), but was tailored to fit the needs and requirements of the BCT-M Program. As stated earlier, 3CE developed the M&S Federation and also led the integration events.

The Acceptability Criteria were the "heart and soul" of the M&S Federation Accreditation because they address the suitability of the M&S Federation for the current intended specific use and guided the collection of V&V artifacts. Before developing the Acceptability Criteria, a solid understanding of the supported test event was acquired. The Acceptability Criteria were developed based on three converging elements:

1. Program and Technical Path – The Program factor was based on the test Assessment Objectives (AO) that were traced through System of Systems (SoS) Engineering and Integration (SSEI) Integrated Product Team (IPT) documentation back to FCS Program requirement documents. Specifically, the 31 AOs for the SO1 TFT were reviewed and analyzed. Only 10 system-oriented AOs were identified as being associated with M&S.

[2] The SO1 TFT Test Requirements were identified in the Technical Requirements Alignment Matrix (T-RAM), which showed the link to the Objective System Test Requirement Document (OSTRD) via a Requirements ID (RID) number.

The Technical factor was based on the 307 Test Requirements, developed by the Test Manager, to support the test event. The list of 307 Test Requirements were analyzed against the initial set of Acceptability Criteria Metrics, and many were identified as not applicable (NA) or outside the VV&A scope though necessary for the test event. Therefore, out of the 307 Test Requirements, 213 were determined to be "true" M&S Requirements. The analyses conducted on the AOs and Test Requirements helped to refine and shape the Acceptability Criteria and Metrics.

2. Policy Path – The Policy Path was based on DoD, the Army, and Command-oriented policies. The specific policy guides supporting this test event were: DoD 5000.61 (DoD); DA PAM 5-11 (Department of the Army); and ATEC Reg 73-21 (HQ Army Test and Evaluation Command). From these policies, three additional and essential criteria were identified: configuration management, data pedigree (i.e. obtained from an authoritative source); and federate components communication amongst themselves.

3. Intended Use Cases Path – The Intended Use Cases Path was based on the Detailed Test Plan that identified the test cases to be executed during the test. Before finalizing the Acceptability Criteria and Metrics, the test cases were reviewed and analyzed against the Intended Uses looking in-depth at the specific Use Cases or test scenarios and how the M&S was applied.

From these three converging paths, three Traceability Analyses Matrices were developed:

1. Acceptability Criteria Metrics (ACMs) to the Assessment Objectives (AOs);
2. ACMs to the 307 M&S Test Requirements, defined by the Test Manager; and
3. ACMs to the Intended Uses (IUs).

From these traceability analyses conducted six benefits were derived as follows:

1. Helped to refine and shape the Acceptability Criteria (AC) and the Metrics (ACMs);

2. Resulted in identifying 213 requirements as being "true" M&S requirements;

3. Provided the essential underpinning for the Accreditation Assessment methodology, including how best to present the traceability and support of the V&V evidence in a top-level Accreditation Assessment summary format;

4. Served as useful template to present top-level Accreditation Assessment summary in the most test related context, from the customer's and user's perspective, supported by the M&S requirements traceability matrix;

5. The ACMs and the Test Requirements Traceability Analysis were deemed "priceless" by both the V&V and Accreditation Teams. The Traceability Matrices were the "backbone" of the Accreditation Assessment methodology providing a solid foundation to explore and present the data from multiple perspectives: Acquisition Decision maker, Test Manager, Test evaluator and M&S SME.

6. These rigorous Accreditation activities allowed 9 Acceptability Criteria and 25 Acceptability Criteria Metrics to be approved for the SO1 TFT M&S Federation.

Some of the V&V activities proved to be of great help to the Accreditation Team including the development of two standardized forms:

- V&V M&S Federation, federates, components, and support tools Description Form - standardized format of V&V documentation that described in detail what the M&S component brought to table and how it would be used. These forms were completed by the component developers.

- V&V Artifact Log Form - described the M&S requirement in detail, data collection events, verification method & status, ACMs supported, procedure and results. The log forms were completed by the V&V Team. The form provided standardized format as part of V&V process and documentation supporting the M&S Accreditation.

4. Results

The SO1 TFT M&S Federation was part of the "common SO1 M&S/tools federation solution" for all SO1 test events. However, each test event had different responsible organizations, test objectives, applications, and M&S requirements. Based on these differences and required updates to the SO1 M&S Federation to support subsequent tests, per AR 5-11, a separate accreditation of the federation

was required for each intended use, in this case, for each test event.

The Accreditation, V&V and Independent V&V (IV&V) Teams participated in the SO1 TFT Federation Integration Events (IE) in order to understand the federation and its components and to verify the M&S requirements and objectives. The IEs were also used to validate the M&S requirements and Assessment Objectives of the SO1 TFT M&S Federation. The IEs, which took place from October 2007 to January 2008, served as the final V&V events to ensure that all problems identified during earlier IEs were fixed and to demonstrate that the SO1 TFT Federation functioned as expected in support of the SO1 TFT. Due to software delays, the final acceptance event was the TFT Dry Run which took place in February 2008, just days before SO1 TFT execution.

The Preliminary Test Readiness Review (PTRR) was held on 25 January 2008 and the overall recommendation presented by the Accreditation Team was to continue with TFT as scheduled, because MET was anticipated by the Test Readiness Review (TRR).

Additional testing was completed, and data were collected during the TFT Dry Runs, 13 - 19 February 2008.

The TRR was held on 22 February 2008. The overall accreditation status at the time of the TRR was "Met" for the following reasons:

- All requirements were verified;
- All results were validated; and
- All Acceptability Criteria were Met.

There were no outstanding Accreditation issues. All M&S capabilities needed for SO1 TFT were successfully demonstrated prior to the TRR. Acceptability criteria metrics were sufficiently met to support a favorable accreditation recommendation prior to SO1 TFT TRR.

The overall recommendation presented by the Accreditation Team was an Unconditional Accreditation of the SO-1 TFT M&S Federation in support of the SO-1 TFT Runs for Record. The "Accreditation Decision Memorandum for Record (MFR)" dated 22 Feb 2008 officially authorized the use of the SO1 TFT Federation in the SO1 TFT Test for Record.

5. Lessons Learned

The lessons learned fall into three categories: operational / implementation; process; and the combination of the two categories.

Operational / Implementation

- Participate in Integration Events and Dry Runs,
- Develop Traceability Matrices,
- Develop relevant Acceptability Criteria and Metrics,
- Expand Intended Uses to include Metrics, and
- Leverage resources and VV&A documentation where possible.

Process

- Start early – planning & working with complete VV&A Team,
- Engage all stakeholders early,
- Coordinate the staffing and approval requirements,
- Develop Accreditation standardized formats,
- Refine V&V standard forms to better support Accreditation, and
- Establish an Accreditation process that can used in subsequent tests, if possible.

Both Categories: Operation / Implementation and Process

- Encourage Team work, and
- Use a collaborative environment – to make information sharing and internal reviews easier.

6. Sharing VV&A Forms/Formats Developed

The SO1 TFT VV&A Team developed 5 forms and /or formats that were proven useful regarding V&V and Accreditation activities. Further the usefulness of these forms and formats, listed below, have been substantiated via support to other test and demonstration events:

1. M&S Federation, federates, components, and support tools form

V&V Form Description for M&S f

2. V&V Artifact Log form

V&V Activity Log - Blank Form.doc

3. Acceptability Criteria Traceability to M&S Requirements Matrix

Traceability Analysis Matrix form.xls

4. Accreditation Assessment (AA) Summary

M&S Accreditation Assessment Summary

5. AA M&S Intended Use Summary

Accreditation Assessment Intended

7. Conclusion

This paper presents the Accreditation activities conducted on the M&S Federation supporting the SO1 TFT to ensure realistic operational context. An M&S System-of-Systems (SoS) level federation was developed to provide virtual and constructive simulation capabilities that enabled holistic testing with complex integration among all entities in a distributed Live-Virtual-Constructive (LVC) environment.

Specifically, this paper discussed how the Accreditation Team:

1. Dealt with constraints;
2. Developed the Accreditation Criteria and Metrics based on the convergence of three paths: Program and Technical Path; Policy Path; and Intended Use Cases Path;
3. The three Traceability Analyses conducted and their benefits;
4. Identified two standardized forms developed by the V&V Team that were found to be most helpful;
5. Summarized the results of the Accreditation Assessment to support readiness reviews;
6. Provided the summarized Accreditation results presented at readiness reviews;
7. Identified lessons learned; and
8. Provided blank forms and formats that would be useful for the conduct of V&V and Accreditation activities supporting any test or demonstration events.

8. References

DoD Directive 5000.61, *" DoD Modeling and Simulation (M&S) DoD Verification, Validation, and Accreditation (VV&A)"*

DMSO, *"DoD Verification, Validation, and Accreditation Recommended Practice Guide, Year 2000 Edition,"* May 2000

DoD Directive 5000.59-P, "*Modeling and Simulation Master Plan"*

DoD Directive 5000.59-M, *"Glossary of Modeling and Simulation Terms"*

AR 5-11, *"Management of Army Models and Simulation",* February 2005

DA PAM 5-11, *"Verification, Validation and Accreditation of Army Models and Simulation,"* September 1999

TEMA, *"Guidelines: Modeling and Simulation in Support of Test and Evaluation,"* 18 April 2000

AR 73-1, *"Test and Evaluation Policy",* August 2006

ATEC PAM 73-21, *"Modeling and Simulation Verification, Validation, and Accreditation Methodology," April 2007*
"Accreditation Plan for the Modeling and Simulation Federation Supporting the Future Combat Systems (FCS System of Systems Development and Demonstration (SDD) Integration Phase 1 (IP1)for Spin Out 1 (SO1) Technical Field Test (TFT)" dated 17 December 2007

Briefing - *"Accreditation Assessment for the Preliminary Test Readiness Review (PTRR)" dated 31 January 2008*

Briefing - *"Accreditation Assessment for the Test Readiness Review (TRR)" dated 22 February 2008*

"Accreditation Report for the Modeling and Simulation Federation Supporting the Future Combat Systems (FCS System of Systems Development and Demonstration (SDD) Integration Phase 1 (IP1)for Spin Out 1 (SO1) Technical Field Test (TFT)" dated 3QFY09

9. Authors' Biography

DEBRA RIDGEWAY is an Operations Research Systems Analyst with over 27 years of experience, of which 10 years has been focused on Modeling and Simulation policies, use and implementation. Her experience was gained working at the Army Materiel Systems Analysis Agency; the Soldier and Biological, Chemical Command; HQ Army Materiel Command; and HQ DA, G-3/5/7. Currently, Debra is matrixed from the HQ Developmental Test Command (HQ DTC), to support the PM Combined Test Organization, PEO-Integration. She is responsible for accrediting M&S Federations supporting Technical Field Test and laboratory demonstration events.

Ms. Ridgeway is a graduate of Daemen College, Amherst, NY; the Army Logistics Management College, Fort Lee, VA and the Army Management Staff College, Fort Belvoir, VA. She has also completed graduate studies at George Washington University, Washington, DC and Boston University, Tyngsboro, MA.

MARGUERITE (PEGGY) DYMOND is an Operations Research Analyst with over 27 years of Army experience. Her experience was gained working at the Army Materiel Systems Analysis Activity as an analyst in air defense, aviation, and simulation branches. Currently, she supports the M&S Division of Army Evaluation Center at Aberdeen Proving Ground, MD, with V&V and accreditation expertise to facilitate the application of M&S to test and evaluation.

Mrs. Dymond is a graduate of Vassar College and the Johns Hopkins' Whiting School of Engineering with a Masters' degree in Computer Science. She has also completed graduate studies at New York University.

FUTURE COMBAT SYSTEMS

FCS

One Team-The Army/Defense/Industry

Future Combat System Spinout1 Technical Field Test (FCS SO1 TFT) Establishing and Implementing Modeling and Simulation (M&S) System of System (SoS) Verification, Validation and Accreditation (VV&A) Practices, Methodologies and Procedures

for the

2010 ITEA LVC Conference

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Accreditation Lead

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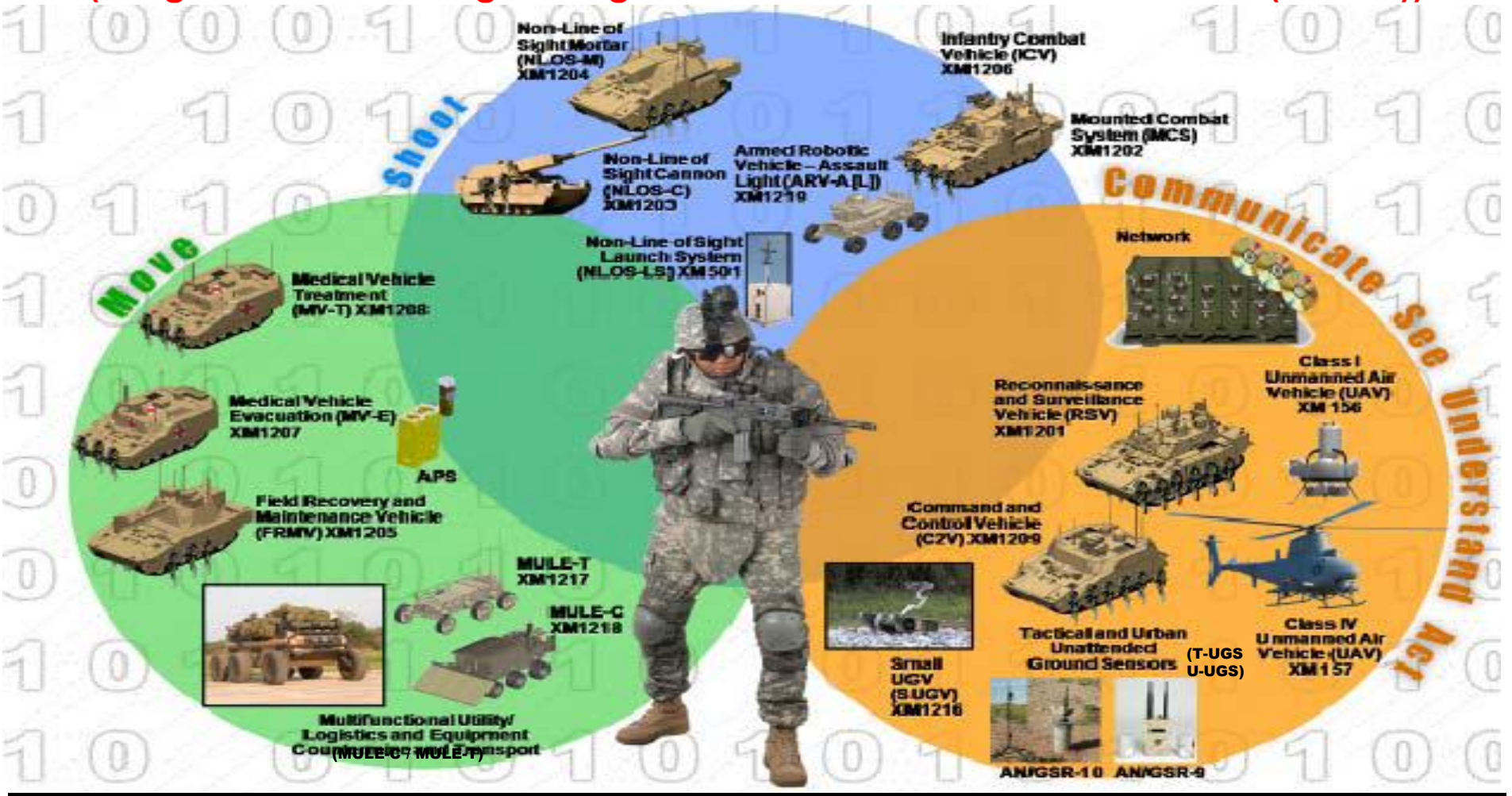
Agenda

1. **Background -- FCS Program Overview**
2. **Constraints**
   - VV&A Roles and Responsibilities
   - Planning and Execution Schedule Used
   - Test Requirements
   - Modeling and Simulation (M&S) Federation
   - Spinout 1 (SO1) Live-Virtual-Constructive (LVC) Operational View
3. **Accreditation Team's Approach Used to Accredit SO1 M&S Federation**
   - Practices
   - Methodologies
   - Procedures
4. **Results and Lessons Learned**
   - Summarized Verification and Validation (V&V) Artifacts' Results
   - Summarized Accreditation Assessment Results
   - Operational/Implementation and Process Lessons Learned
5. **Disparity Island**
6. **Questions**
7. **Back-up charts** **(includes Acronym List & templates of standard forms developed)**

Background: FCS Program Overview

(Program transitioning to Brigade Combat Team – Modernization (BCT-M))



The FCS program, considered the core building block of the Army's future force, consists of the following elements:

- The network (information and communications) +
- 14 individual combat systems including manned and unmanned systems +
- The soldier .

Because all of the constituent parts of the FCS program are viewed as systems in themselves -- including the 14 sub-systems, the network itself, and even the individual soldier -- it is commonly referred to as the "**14+1+1" system or a "system of systems.**"

Constraints

- VV&A roles and responsibilities
- Essential FCS documents (e.g., DTP, ORD/CDD, etc.)
- Planning and Execution Test Schedule
- 307 Test Requirements generated by Test Manager, the Lead System Integrator (LSI), which is the contractor that executed the SO1 TFT event
    - 213 M&S Requirements
- M&S Components – federation, support tools and data integrated by Cross Command Collaborative Effort (3CE)
- Accreditation Team involvement began after everyone else

VV&A Roles and Responsibilities

	V&V Agent (Lead)	IV&V Agent (Lead)	Accred. Auth. [Designee]	Accred. Agent** (Lead) [Designee]
SO-1 TFT	LSI V&V Team (LSI)	MSO IV&V (LSI)	PM FCS [GO]	PM FCS MSO (MSO) [Debra Ridgeway]
SO-1 FDT&E	TRADOC LSI V&V Team*	MSO IV&V* (LSI)	CG TRADOC [GO]	TRADOC FFID M&S
SO-1 Pre-LUT	ATEC (OTC) LSI V&V Team*	MSO IV&V* (LSI)	CG ATEC *** [GO]	ATEC AST (AEC) [OTC]
IMT-1	LSI V&V Team	MSO IV&V (LSI)	PM FCS GO [MSO]	N/A
Exp. 2.1	LSI V&V Team	MSO IV&V (LSI)	PM FCS [GO]	N/A

* *Support Agent's process as requested by MSO*

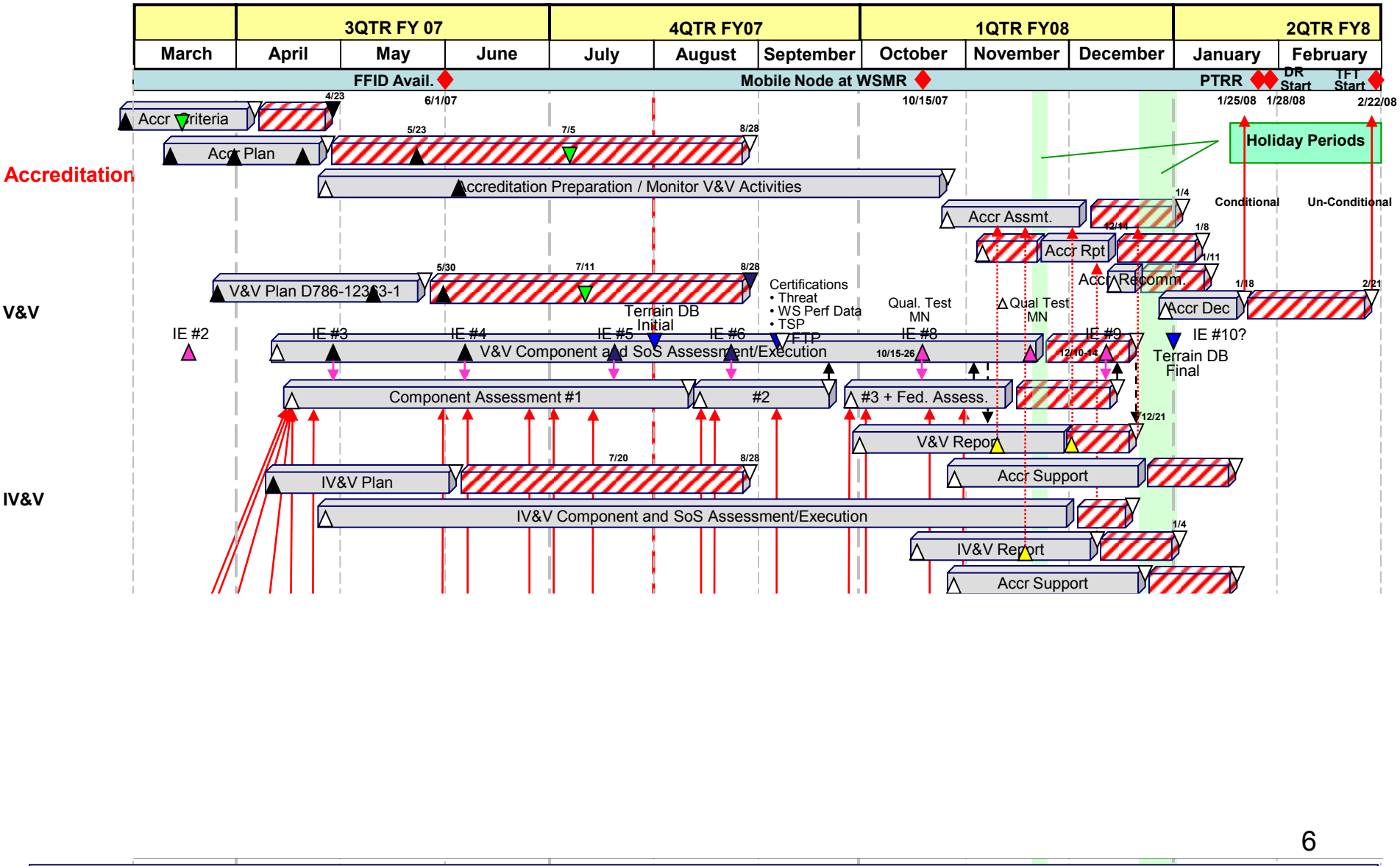
** *Accreditation Authority designates accreditation agent (organization) and lead staff*

*** *ATEC will certify M&S for LUT*

Note: In cases where ATEC plans to use data from other than the LUT event, CG ATEC will be afforded the opportunity to accredit the M&S used to support such events.

VV&A Planned for Execution Schedule for SO1 TFT

Revision 16 17 Sep 07



LEGEND: Program Inchstone; Item Start/Finish (Planned); Item Start/Finish (Actual); Draft (Unapproved) Planned/Actual; M&S Delivery Planned/Actual; SO1 M&S Integration Event; Data; No Impact To SO1 TFT

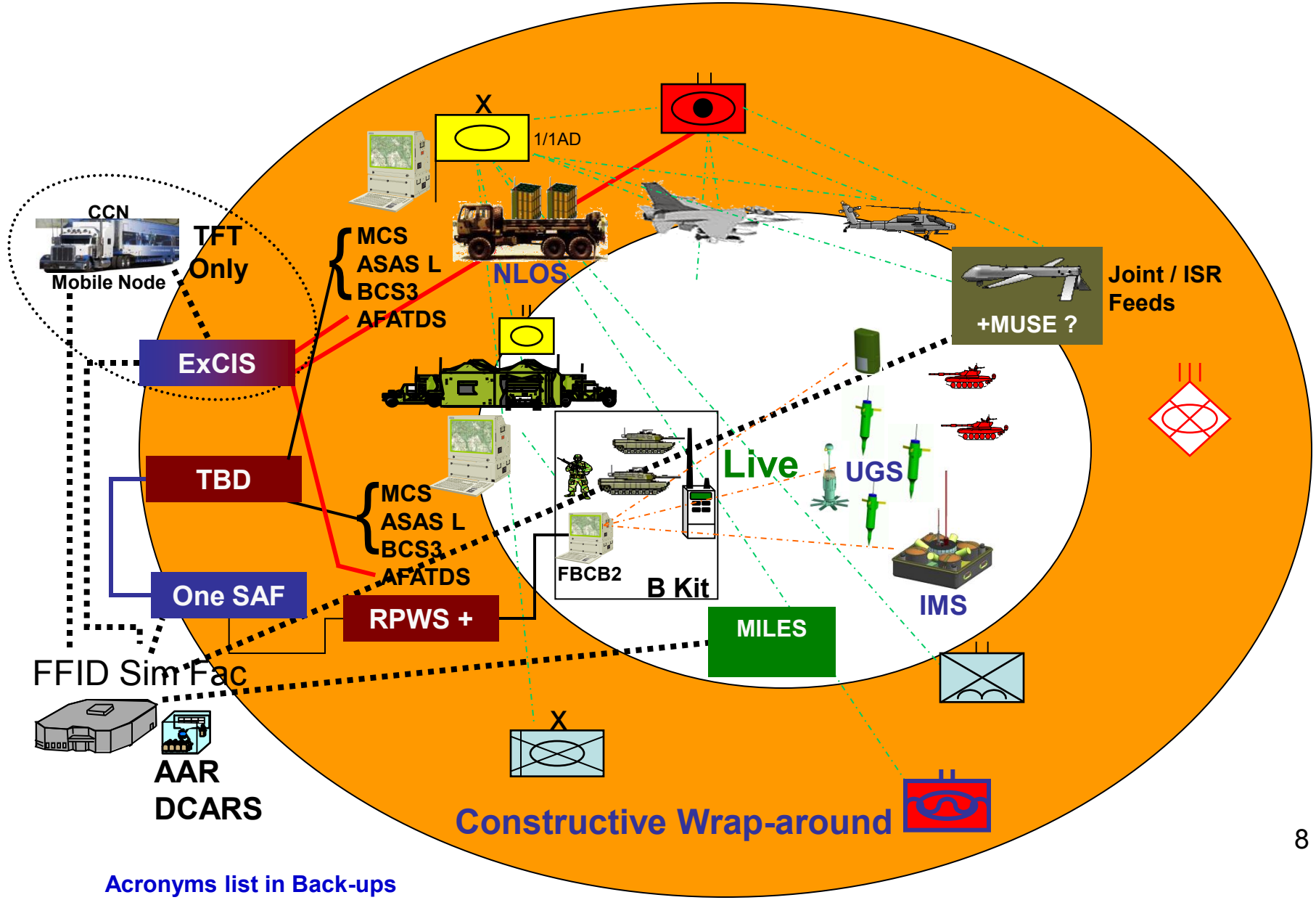
SO1 TFT M&S Federation, Data and Support Tools*

M&S Category	M&S Tool Name	Common Name / Acronym	Provider	Intended Use
M&S Federation	Objective Force-One Semi-Automated Force Objective System	OneSAF	PM OneSAF	CGF; 2D Display of Battlefield (Simulated and live); Scenario generation.
	Command and Control Adapter (part of Objective Force-One Semi-Automated Force Objective System)	C2 Adapter (part of OneSAF)	PM OneSAF	Converts OneSAF internal format messages to tactical JVMF; Converts tactical JVMF messages to OneSAF internal format
	Extensible (C4I) Instrumentation Suite	ExCIS	OTC	Interface to live AFATDS required for NLOS-LS Fire Control Solution; Simulated NLOS-LS PAM fly out
M&S Data	WSMR Terrain Database	WSMR TDB	TEC	Digital representation of the event execution area. Terrain of WSMR for common use by the federation.
Federation Support Tools	Digital Collection, Analysis, and Review System II / Reconfigurable Intelligent Instrumentation to Collect, Simulate and Stimulate	DCARS / RICS	EPG	Data collection, monitoring, near real-time review, storage, and AAR capability
	STARSHIP II (Starship / StarGen)	Starship StarGen	PM ITTS	Monitor and control health and status of (RICS)2 and HLA federates
	Modeling Architecture for Technology, Research and EXperimenation - Federation Object Model - Run Time Infrastructure	MATREX - FOM - RTI	RDECOM / MATREX	Controlling mechanism for HLA federation
	3 Dimension Visualization	3DViz (Part of MATREX)	RDECOM / CERDEC / NVESD	Provides ground truth with near real-time 3D visualization of battlefield for Live and Constructive entities.
	Acquisition Reporting and Display System	ARDS	WSMR	Ground truth for live assets instrumented with ARDS pods.
	Fort Bliss Homestation Instrumentation Test System	Fort Bliss HITS DCNC EXCON VR Exchange	EPG	Provide ground truth of live vehicles to HLA Federation via instrumentation. Also provide AAR capability.
	Test Conduct Reporting System	TCRS	EPG	Test management and data collection/reporting
	Orin Test Talk	TestTalk	EPG	Test situational awareness
	C4ISR Test Took Kit - Data Reduction and Analysis	CTTK-DRA	EPG	Near real-time and post-test analysis and reduction of data collected from FCS platforms instrumented with the EPG Data Collection Suite.

* Federation integrated by Cross Command Collaborative Effort (3CE) and was part of the “common SO1 M&S federation / tools solution”

Notional SO-1 LVC Operational View

Live-Virtual-Constructive Integration

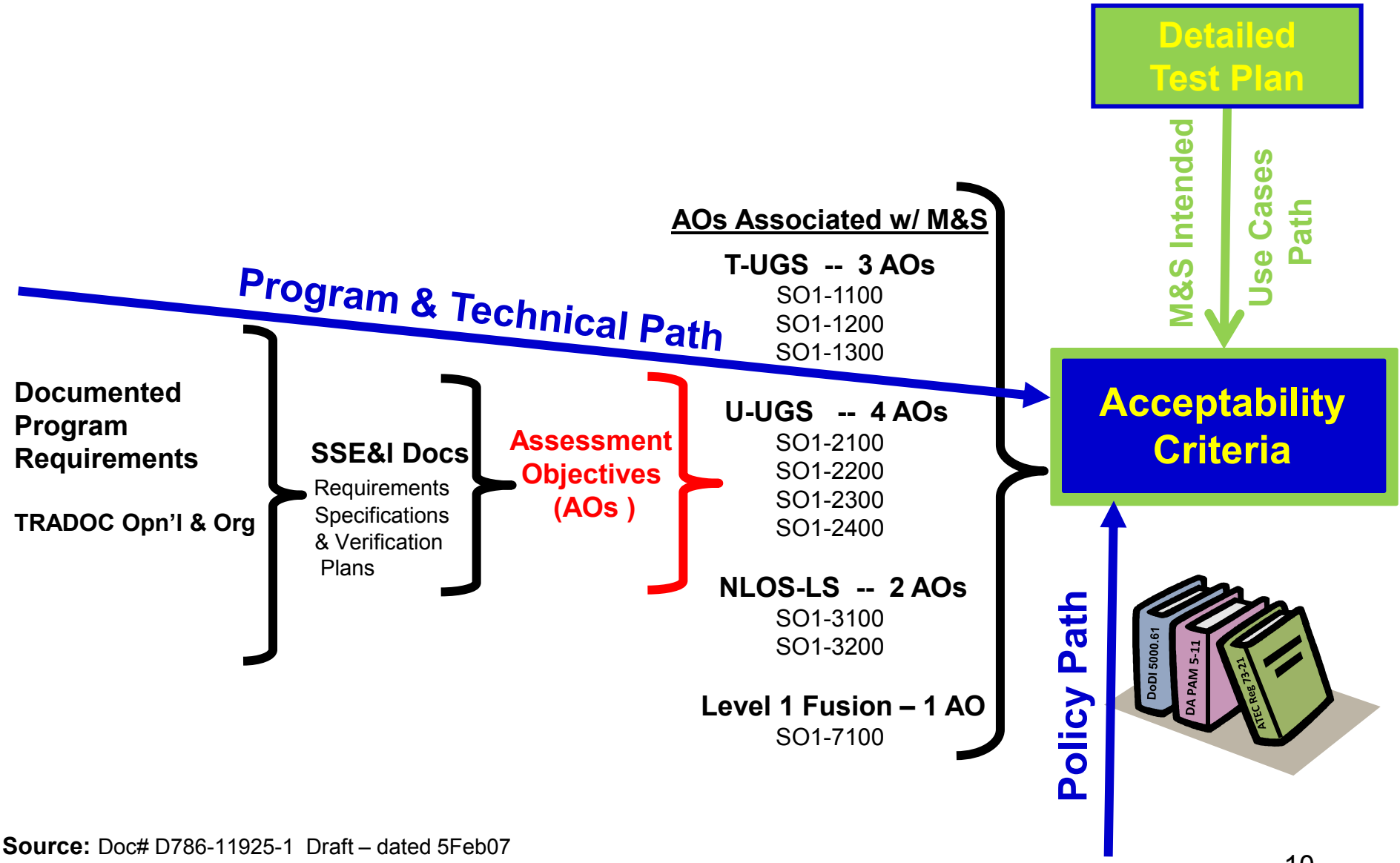


Acronyms list in Back-ups

Accreditation Team's Approach Used to Accredit SO1 M&S Federation

Practices, Methodologies and Procedures

Determining Acceptability Criteria



Source: Doc# D786-11925-1 Draft – dated 5Feb07

Approved FCS SO1 TFT Acceptability Criteria and Metrics

AC#	Acceptability Criteria Title	SO1 TFT Acceptability Criteria (AC) Descriptions	ACM #	SO1 TFT AC Metrics
1	Terrain representations are at required resolution.	This federation must provide consistent realistically and doctrinally correct simulated terrain and environment representations of the test site terrain as defined in the Integrated Phase 1 (IP1) Detailed Test Plan for Spin Out 1 (SO1 DTP) TFT dated 6 March 2007; System Evaluation Plan (SEP) for FCS SO1 dated 25 January 2007; and FCS Test and Evaluation Master Plan (TEMP) dated 7 April 2007 to support the integration of the Live and Constructive (LC) environment across all involved SO1 TFT entities.	ACM1-1	Terrain scalability
			ACM1-2	Terrain 3-D display
			ACM1-3	Terrain representation
2	Configuration Managed Federation.	This federation for SO1 TFT must ensure operational consistency regarding its functional use and capability, and physical characteristics, as described in AR 5-11, Chapter 6, Configuration Management, which includes, but not limited to, purpose, assumptions, limitations etc. that must be documented and properly maintained after 3CE hand-off to test event lead.	ACM2-1	Configuration identification
			ACM2-2	Configuration control
			ACM2-3	Configuration status accounting
			ACM2-4	Configuration history
3	The simulated entities must perform and interact as required to support the SO1 TFT.	The simulated entities (e.g., vehicles, soldiers, etc.) for the SO1 TFT must be realistic representations, correctly identified and defined in the DTP and TEMP to include proper interactions between simulated and live entities, correlated terrain and must meet the standards as defined in the Technical Requirements Alignment Matrix (T-RAM).	ACM3-1	ID of simulated entities & objects
			ACM3-2	Representation of CF, threat entities & SO1 systems
4	All federation input data must be identified and provided as required for SO1 TFT and certified for the intended use by authoritative source(s).	Data used in models and simulations, as part of the federation supporting the SO1 TFT, must be verified, validated, and certified (VV&C) for intended use, as described in AR 5-11, ATEC PAM 73-21 and SEP. Data must be obtained from Government Furnished Equipment (GFX) or from the FCS One Team Partners (OTPs) responsible for the provision of the articles under test in the TFT.	ACM4-1	V&V of input data
			ACM4-2	Data certification letter
5	SO1 TFT Federation must run in real-time to support live test.	Simulated entities must operate in real-time, appear correctly on the live-systems' and constructive-systems' displays from the entities generated by individual federates and the federation as a whole in order to produce and update entities at the same rate as the systems under test.	ACM5-1	No message delay
			ACM5-2	No ground truth delay
6	The SO1 TFT Federation must support/interoperate with current force battle command networks.	The TFT Federation must be able to communicate/ interoperate with existing live and simulated Army battle command / systems networks. Federation entities must accurately send, receive, acknowledge, and display required tactical messages. In addition, the Federation must be able to simulate the Non-Line-of-Sight - Launch System (NLOS-LS) as required by the TFT. The Federation must be able to execute timely NLOS-LS fire missions based on receipt of observed targetable data.	ACM6-1	Commo & interoperate w/ existing Army Fire controls
			ACM6-2	Fire mission - PAM flyout
			ACM6-3	Tactical message - accurately transmit & receive
7	The SO1 TFT Federation must populate the Common Operation Picture (COP) with simulated entities.	The SO1 TFT federation must provide Situational Awareness (SA) on Force XXI Battle Command Brigade and Below (FBCB2) displays in B-kit current force vehicles and in simulated and live Advanced Field Artillery Tactical Data Systems (AFATDS.) SA will consist of position and identification (Blue and Red) for all simulated entities. Appropriate messages must be transmitted and received between simulated and live entities in the operational environment. Live must be displayed on the simulation window and simulated must be displayed on the Live window.	ACM7-1	Network display of SA
			ACM7-2	Position data
8	The SO1 TFT federates must communicate among themselves via appropriate protocols.	Federates must also be able to communicate among themselves via DoD High Level Architecture (HLA) and Federation Object Model (FOM) enumerations or Distributed Interactive Simulation (DIS) protocols, as appropriate.	ACM8-1	Federation compliance
			ACM8-2	Federation RTI - testing threshold for repeatability
			ACM8-3	Federation RTI interface Specs
			ACM8-4	Federation Messages - accurately transmit & receive
9	All federation output data must be adequate, credible and in a usable format.	SO1 TFT federation output data must be properly formatted, adequate and credible for use in After Action Report (AAR), analysis and follow-on test events (e.g., Force Development Test and Experimentation (FDTE), Limited User Test (LUT) and FCS Core test events) across the entire spectrum of valid input data.	ACM9-1	Reasonable Federation Output
			ACM9-2	Graphical output
			ACM9-3	Output Data Format

Traceability Analyses

Developed three sets of Traceability Analyses Matrices

1. Traced Acceptability Criteria Metrics (ACMs) to the Assessment Objectives (AOs).
2. Traced ACMs to the 307 Test Requirements, defined by the Test Manager.
3. Traced ACMs to the Intended Uses (IUs).

Traceability Analyses Benefits

1. Helped to refine and shape the Acceptability Criteria (AC) & ACMs.
2. Resulted in identifying 213 Test Requirements as being "true" M&S Requirements.
3. The M&S Requirements traceability matrix provided the essential underpinning element for the Accreditation Assessment methodology, including how to best present the traceability and support of the V&V evidence in a top-level Accreditation Assessment summary format.
4. The IUs traceability matrix served as useful template to present top-level Accreditation Assessment summary in the most test related context, from the customer's and user's perspective, supported by the M&S Requirements traceability matrix.
5. The ACMs and 307 Test Requirements Traceability Analysis was deemed the most helpful and "priceless" by both the V&V and Accreditation Teams.

Traceability Matrices were the "backbone" of the Accreditation Assessment methodology!

Excerpt - Summary SO1 TFT ACMs-307 Test Rqts Traceability Analysis

Acceptability Criteria Title	TFT ACM #	TFT ACM Descriptions	T-RAM (M&S Rqts)	Total T-RAM Rqts Addressed
Terrain representations are at required resolution	ACM1-1	**Scalability:** Shall provide/display scaleable terrain resolution from low to high as appropriate for the test article or federation component participating in SO1 TFT.	TFT273, TFT279	2
	ACM1-2	3-D: Shall provide/ display maps and three-dimensional views of terrain for SO1 TFT vignettes upon demand. Maps are typically 2-D.	TFT245, TFT273	2
	ACM1-3	**Terrain Representation:** Terrain representation must include: comparable elevation and feature data; compatible data formats and coordinate systems; environmental effects and necessary elevation interpolation	TFT38	1
Configuration Managed Federation	ACM2-1	**Configuration identification.** Settle on the federation components, to include name, date and version that will be used in test NLT 7 months prior to the test to allow sufficient time for pre-test prep (e.g., integration and interoperability testing of components). **[Though not a test metric, this is critical issue that shall remain here until resolved. Federation configuration identification is V&V artifact and shall be mentioned in the accreditation plan.]**	Requirement maps to Army M&S policy, AR 5-11, not to T-RAM.	
	ACM2-2	**Configuration control**. Enable all authorized users to have the current federation components and associated documents available at all times so that none are working with out-of-date material.	Requirement maps to Army M&S policy, AR 5-11, not to T-RAM.	
	ACM2-3	**Configuration status accounting.** Ensure that no changes are made to the federation baseline without proper review and approval, preserving the federation's intended purpose, schedule, and cost.	Requirement maps to Army M&S policy, AR 5-11, not to T-RAM.	
	ACM2-4	**Configuration history.** Provide traceability for configuration modifications during the SO1 TFT federation life cycle, after 3CE hand-off, as appropriate.	Requirement maps to Army M&S policy, AR 5-11, not to T-RAM.	
The simulated entities must perform and interact as required to support the SO1 TFT.	ACM3-1	**Identification of Simulated Entities / Objects:** Simulated and live entities (e.g., soldiers, vehicles, etc.) and neutral objects shall appear and must be correctly identified as expected for the SO1 TFT vignettes.	TFT267, TFT266, TFT7, TFT294, TFT216	5
	ACM3-2	**Current Force and Threat Entities and SO1 Systems:** These simulated entities (soldiers, vehicles, etc.) shall appear and perform as expected for their intended use based on the SO1 TFT vignettes. Entities shall also display the right level of fidelity, complexity and level of detail that are acceptable for its intended usage.	TFT147, TFT126, TFT184, TFT127 TFT128, TFT42, TFT15, TFT16, TFT36, TFT17, TFT39, TFT28, TFT29, TFT150, TFT226, TFT185, TFT134, TFT135, TFT133, TFT257, TFT41	21
All federation input data must be identified and provided as required for SO1 TFT and certified for the intended use by authoritative source(s)	ACM4-1	**V&V of input data:** Input data used in the SO1 TFT federation will be verified and validated, and accredited/certified for this specific intended used, as appropriate mindful of the components and test articles classification that will be used to conduct the test. (ATEC PAM 73-21)	TFT296, TFT251	2
	ACM4-2	**Data Certification Letter:** Input data verification, validation and certification are required to be substantiated by a letter certifying its use. This letter signed by the data proponent organization's commander, agency head or authorized designee certifies that this data is appropriate for this specific intended use, providing the scope of its use such as known constraints, assumptions, caveats, classification, etc.	Requirement maps to Army M&S policy, AR 5-11, not to T-RAM.	
The SO1 TFT Federation must run in real-time to support live test.	ACM5-1	**No delay:** No perceivable message or display delay or data packet loss during real time operation to include messages received and displayed on the COP. [Supports information timeliness .]	TFT192, TFT10	2
	ACM5-2	**Ground Truth Display:** No abnormality in perceived ground truth display, the degree to which the federation matches/keeps up with the live test.	TFT273, TFT216, TFT12, TFT239, TFT268	5

V&V Description Form for M&S federation, federates, and support tools

- Described in detail what the M&S component brought to table and how it would be used, expected final version, etc.
- Forms were completed by the developers.
- A standard form was developed to document V&V information for all the M&S Federation, federates, components, and support tools.

[1]Model/Simulation/Tool Name		[4]Provider Org	
		[5]POC Name	
[2]Version	[3]Release Date	[6]Phone	
		[7]Email	
[8]Description/Capabilities			
[9]Assumptions			
[10]Limitations			

Input Data Used for SO1 TFT		
[11] Terrain DB	[12] Description	[13] Data Source
[14] File Name	[15] Description	[16] Data Source
[17] Embedded Data		
[18] Other Data		

Output Data Available for SO1 TFT	
[19] File Name	[20] Description
[21] Other Output Data	

SO1 TFT Federation Specific Data			
[22] Intended Use w/in Federation	[23] Description		
[24] Federation Data Published	[25] Data Subscriber	[26] Data Description	
[27] Federation Data Subscribed	[28] Data Publisher	[29] Data Description	
[30] Tactical/Live Component I/F	[31] Data Network	[32] Send/ Receive	[33] Data Description
[34] Other Data I/F	[35] Data Network	[36] Send/ Receive	[37] Data Description

Example of Completed SO1 TFT V&V Artifacts Log

- Described M&S requirement in detail, who performed , at what event was data collected , verification method & status, ACMs supported, procedure and results.
- Completed by the V&V Team.
- Form provided standardized format as part of V&V process and documentation supporting the M&S Accreditation .

Task ID	V&V Activity Log			Log #
4.4.5.6	**Name**	Verify Implementation of Requirements		x-TFT 2
Description	**Technical Requirement:** The SO1 M&S Federation shall provide the capability to create, modify, copy, and delete a force-on-force scenario. **Requirement Understanding:** Use OOS Management & Control Tool (MCT) **Requirement Limitation** N/A **Verification Criteria** 1) Demonstrate create scenario 2) Demonstrate modify scenario 3) Demonstrate copy scenario/ rename scenario 4) Demonstrate delete scenario 5) Demonstrate merge scenario			
Performed By	Becky Hill		**Date**	11/1/07
Supporting Test Event	**IE8**		**Date**	**10/25/07**
Verification Method	**Demonstration**	**Verification Status**		**Met**
Procedure	Perform independent assessment of OOS-OF (v##) MCT to verify scenario generation capabilities.			
Results	1) Scenario created through selection of “New” under the “File” menu; entities / units can be added; force structure created; initial conditions assigned to entities. (See attached: Create Scenario) 2) Any loaded scenario can be modified through the entity “Status” , the “Task Organization” or the “Mission Editor” windows. (See attached: Modify Scenario – only “Status” window is shown) 3) Scenario can be copied/renamed via Windows copy/paste or via the OOS MCT “Save As” option 4) Scenario can be deleted via Windows delete or via the OOS MCT “Delete” option within the “Manage Scenarios” feature (See attached: Manage Scenario) 5) Scenarios may be merged by opening them simultaneously in the OOS MCT and then doing a “Save As” to create a new scenario that is inclusive of the set of opened scenarios.			

Legend: **Risk** **Met (M)** **None** | **Met Minus (M-)** **Low/Minor** | **Partially Met (PM)** **Medium/Moderate** | **PM Minus (PM-)** **Major** | **Not Met (NM)** **Catastrophic/High** | Not Tested

Results
and
Lessons Learned

SO1 TFT M&S V&V Artifacts' Summary

Verification Activities

Requirements Implementation Verification

- 210/213 Requirements Met
- 3 Requirements Partially Met
  - No Impact to M&S Federation Ability to Support SO1 TFT

Data V&V

- No Data Certification of Unclassified Data
- Data Sources Identified
- No Adverse Impacts Due to Unclassified Data
- Consistent use of Data (Terrain, Configuration Files)

Networks / Data Interfaces

- All Simulation to Live and Simulation to Simulation Interfaces Successfully Demonstrated

Discriminator	Total # Req	Requirements Verification Status Following Key Events											
		IE8			IE9			IE9R			V9 Dry Runs		
		M	PM	NT	M	PM	NT	M	PM	NT	M	PM	NT
Classification	2	1	1		1	1		2	0		2	0	
Battlespace Rep	22	6	8	8	21	1		21	1		22	0	
Scenario Generation	35	27		8	31	1	3	31	4	0	35	0	0
Simulate/Emulate ABCS	17		1	16	17			17			17		
Simulate/Emulate SO1 Sys	10		3	7	9	1		10	0		10	0	
Control Cells	1			1	1			1			1		
Live Player Integ	13	2	1	10	13			13			13		
Setup and Execution	15	3	2	10	12	3		14	1		15	0	
Exercise View	27	4	2	21	24	3		24	3		26	1	
Data Collection	65	12	4	49	53	5	7	53	8	4	63	2	0
VV&A Certification	4		1	3	3	1		3	1		4	0	
AAR	2			2	2			2			2		
TOTAL	**213**	**55**	**23**	**135**	**187**	**16**	**10**	**191**	**18**	**4**	**210**	**3**	**0**

Validation Activities

- Mission Threads (Call For Fire (CFF) and Situational Awareness (SA))
- Essential Message Content (HLA, JVMF, AFATDS)
- Scenarios are Reflective of Operational Context

Overall V&V Status

- All Required M&S Capabilities Provided
- M&S V&V Activities Documented in SO1 TFT M&S V&V Report (Draft #2, 8 Feb 08)
- Outstanding Issues Sufficiently Resolved Since Integration Event 9 Regression (IE9R) Test (21-22 Jan 08)
- No Major Issues Outstanding

As 14Feb08 from Becky Hill, V&V Lead

Top-level Accreditation Assessment (AA) Summary

SO1 TFT Test Readiness Review

Accreditation Assessment Summary Results Matrix for M&S Federation Supporting FCS SO1 TFT

Acceptability Criteria (AC) Title	TFT ACM #	TFT ACM Descriptions	ACM Status	AC Status	Accreditation Impact Statement
Terrain representations are at required resolution.	ACM1-1	Terrain scalability	M	M	
	ACM1-2	Terrain 3-D display	M		
	ACM1-3	Terrain representation	M		
Configuration Managed Federation.	ACM2-1	Configuration identification	M	M	
	ACM2-2	Configuration control	M		
	ACM2-3	Configuration status accounting	M		
	ACM2-4	Configuration history	M		
The simulated entities must perform and interact as required to support the SO1 TFT.	ACM3-1	ID of simulated entities & objects	M	M	
	ACM3-2	Representation of CF, threat entities & SO1 systems	M		
All federation input data must be identified and provided as required for SO1 TFT and certified for the intended use by authoritative source(s).	ACM4-1	V&V of input data	M	M	
	ACM4-2	Data certification letter	M		
SO1 TFT Federation must run in real-time to support live test.	ACM5-1	No message delay	M	M	
	ACM5-2	No ground truth delay	M		
The SO1 TFT Federation must support/interoperate with current force battle command networks.	ACM6-1	Commo & interoperate w / existing Army Fire controls	M	M	
	ACM6-2	Fire mission - PAM flyout	M		
	ACM6-3	Tactical message - accurately transmit & receive	M		
The SO1 TFT Federation must populate the Common Operation Picture (COP) with simulated entities.	ACM7-1	Netw ork display of SA	M	M	
	ACM7-2	Position data	M		
The SO1 TFT federates must communicate among themselves via appropriate protocols.	ACM8-1	Federation compliance	M	M	
	ACM8-2	Federation RTI - testing threshold for repeatability	M		
	ACM8-3	Federation RTI interface Specs	M		
	ACM8-4	Federation Messages - accurately transmit & receive	M		
All federation output data must be adequate, credible and in a usable format.	ACM9-1	Reasonable Federation Output	M	M	
	ACM9-2	Graphical output	M		
	ACM9-3	Output Data Format	M		

Legend: Risk — Met (M) None; Met Minus (M-) Low/Minor; Partially Met (PM) Medium/Moderate; PM Minus (PM-) Major; Not Met (NM) Catastrophic/High

As of 15Feb08

Top-level AA M&S Intended Uses Summary

Accreditation Assessment (AA) of SO1 TFT M&S Federation Intended Use (IU)						
Intended Use	IU Metric	AA IU Metric Status	AA IU Status	TFT Accepability Critieria (AC)	TFT AC Metrics	Accreditation Impact Statement

Accreditation Assessment (AA) of M&S Federation Intended Uses (IU) Supporting SO1 TFT TRR

Intended Use (IU)	IU Metric	AA IU Metric Status	AA IU Status	SO1 TFT Accepability Critieria (AC)
Constructive Representation	SO1 Systems	M	M	AC3, AC6
	CF Systems with and w/o B-Kits	M		AC3, AC6, AC7
	Aggregate Entities	M		AC3, AC6, AC7
	Threat Systems	M		AC3, AC5, AC7
	WSMR Terrain	M		AC1
Interface to Live entities via tactical messages			M	AC3, AC5, AC6, AC7
Operational context for SO1 test cases			M	AC3, AC4, AC5, AC6, AC7
Test support			M	AC2, AC4, AC8, AC9

SO1 TFT Test Readiness Review

Legend: Risk — Met (M) None; Met Minus (M-) Low/Minor; Partially Met (PM) Medium/Moderate; PM Minus (PM-) Major; Not Met (NM) Catastrophic/High

As of 25Jan08

SO1 TFT Accreditation Lessons Learned

Operational / Implementation

- Participated in Integration Events and Dry Runs
- Developed Traceability Matrices
- Developed Relevant Acceptability Criteria and Metrics
- Expanded Intended Uses to include Metrics
- Leveraged resources and VV&A documentation where possible

Process

- Started early – planning & working with complete VV&A Team
- Engaged all stakeholders early
- Coordinated the staffing and approval requirements
- Developed Accreditation standardized formats
- Refined V&V standard forms to better support Accreditation
- Established an Accreditation process that has been used in subsequent test and demonstration events

Both Operational / Implementation and Process

- Encouraged Team work
- Used collaborative environment -- made sharing data easier

Templates of Standardized Formats & Forms Developed by VV&A Team

Want to share with others the formats and forms that the SO1 TFT VV&A Team developed and found the most useful to achieve our goal.

Accreditation Formats Developed

- Acceptability Criteria Traceability to M&S Requirements

Traceability
\nalysis Matrix form

- Accreditation: Acceptability Criteria Assessment Matrices
  - Blank
  - Preliminary Readiness Review w/ Risk Impact Column
  - Readiness Review

Accreditation
Assessment Matrix

- Accreditation: Intended Use Assessment Matrices
  - Blank
  - Preliminary Readiness Review w/ Risk Impact Column and Traceability Columns
  - Readiness Review w/ Traceability Columns

AA Intended Use
Matrix

V&V Artifact Forms Developed

- V&V M&S Component / Tool / Support Tool Description Form
  - To be completed by the individual developer

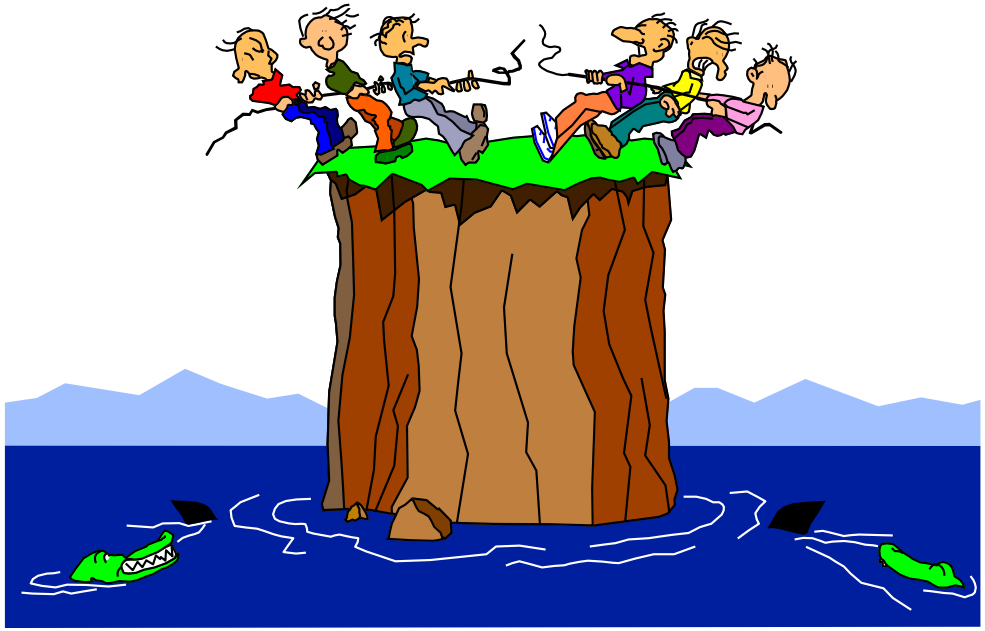
V&V M&S
\ponent Description F

- V&V Activity Log
  - To be completed by V&V Team

V&V Activity Log
form

Disparity Island

Don’t put yourselves on Disparity Island!



Oh boy, dinner!

Yeah, somebody didn’t verify some units, another didn’t val…

Who cares?

Yeah, we get to bite their dust ‘cause in VV&A they didn’t spend the bucks.

Questions?

Back-ups

SO1 TFT Test Goals

The TFT primary goals are to integrate the SO1 systems, demonstrate SO1 capabilities, collect data to address assessment objectives, and provide objective data necessary for leadership to determine if SO1 systems are ready to proceed to FDTE and LUT. In preparation for TFT, the SO1 systems are integrated into a SO1 TFT slice of a current force Heavy Brigade Combat Team (HBCT) organization structure; this slice is identified as the HBCT(-) and is described in section 4.3. The integration will be phase driven by the incremental delivery of SO1 systems, availability of trained soldiers, and the incremental, controlled build-up of systems. Each phase will add increasing complexity leading to the final test configuration. Once integrated, the SO1 capabilities will be tested and demonstrated with a representative slice of the HBCT utilizing soldiers trained on the specific systems operations in a field environment at WSMR. The SO1 capabilities tests and demonstrations will be recorded per the appropriate data requirements so that the AOs can be assessed. The collected data along with the AO analysis results will be provided to leadership at the conclusion of TFT for assessment to proceed to FDTE and LUT.

Source: Doc# D786-11925-1 Draft – dated 5Feb07

References / Sources

1. DoD Directive 5000.61, *" DoD Modeling and Simulation (M&S) DoD Verification, Validation, and Accreditation (VV&A)"*
2. DMSO, *"DoD Verification, Validation, and Accreditation Recommended Practice Guide, Year 2000 Edition,"* May 2000
3. DoD Directive 5000.59-P, "*Modeling and Simulation Master Plan"*
4. DoD Directive 5000.59-M, *"Glossary of Modeling and Simulation Terms"*
5. AR 5-11, *"Management of Army Models and Simulation",* February 2005
6. DA PAM 5-11, *"Verification, Validation and Accreditation of Army Models and Simulation,"* September 1999
7. TEMA*, "Guidelines: Modeling and Simulation in Support of Test and Evaluation,"* 18 April 2000
8. AR 73-1, *"Test and Evaluation Policy",* August 2006
9. ATEC PAM 73-21, *" Modeling and Simulation Verification, Validation, and Accreditation Methodology," April 2007*
10. *"Accreditation Plan for the Modeling and Simulation Federation Supporting the Future Combat Systems (FCS System of Systems Development and Demonstration (SDD) Integration Phase 1 (IP1)for Spin Out 1 (SO1) Technical Field Test (TFT)" dated 17 December 2007*
11. Briefing - *"Accreditation Assessment for the Preliminary Test Readiness Review (PTRR)" dated 31 January 2008*
12. Briefing - *"Accreditation Assessment for the Preliminary Test Readiness Review (PTRR)" dated 22 February 2008*
13. *"Accreditation Report for the Modeling and Simulation Federation Supporting the Future Combat Systems (FCS System of Systems Development and Demonstration (SDD) Integration Phase 1 (IP1)for Spin Out 1 (SO1) Technical Field Test (TFT)" dated 3QFY09*

Acronym List Pg 1 of 3

Acronym	Definition
3CE	Cross Command Collaboration Effort
3DVIZ	Three Dimensional (3D) Visualization
AAR	After Action Review
ABCS	Army Battle Command Systems
AC	Acceptability Criterion
ACE	Advanced Collaborative Environment
ACM	Acceptability Criterion Metric
AEC	Army Evaluation Center
AFATDS	Advanced Field Artillery Tactical Data System
AO	Assessment Objective(s)
ARDS	Acquisition, Reporting and Display System
ASAS L	All Source Analysis System Light
ATACMS	Army Tactical Mission System
ATEC	Army Test and Evaluation Command
BCS3	Battle Command Sustainment and Support System
B-Kit	An installation kit for Group B equipment
BLUFOR	Blue Forces
C2	Command and Control
C4I	Command, Control, Communications, Computers, and Intelligence
C4ISR	C4I Surveillance, and Reconnaissance
CCN	Common Control Node
CF	Current Force
CFF	Call For Fire
COP	Common Operating Picture
CTO	Combined Test Organization
CTTK-DRA	C4ISR Test Tool Kit – Data Reduction and Analysis
DAUVS	Digitized Army USMTF/VMF Stimulator
DCARS	Digital Collection, Analysis, and Review System
DTC	Developmental Test Command
E-IBCT	Early / Enhance Integrated Brigade Combat Team
DTP	Detailed Test Plan
ExCIS	Extensible (C4I) Instrumentation Suite
FBCB2	Future XXI Battle Command Battalion/Brigade and Below
Ft Bliss HITS	Ft. Bliss Homestation Instrumentation Tool Suite
FCS	Future Combat Systems
FDT&E	Force Development Test and Experimentation
FFID Sim Fac	Future Force Integration Directorate Simulation Facility
FOM	Federation Object Model

Acronym List Pg 2 of 3

FSE	FCS Simulation Environment
GPCS	Ground Platform Communication System
HBCT	Heavy Brigade Combat Team
HLA	High Level Architecture
HMMWV	High-Mobility Multipurpose Wheeled Vehicle
IBCT	Integrated Brigade Combat Team
IE	Integration Event
IHITS	Initial Homestation Instrumentation Test Systems
IMS	Integrated Master Schedule
IMT1	Integrated Mission Test One (1)
IPT	Integrated Product Team
IPS&T	Integrated Phases, Simulation and Test
IRS	Intelligence, Surveillance, and Reconnaissance
IS&T	Integration, Simulation & Test
IU	Intended Use
IV&V	Independent Verification and Validation
JTRS	Joint Tactical Radio System
JVMF	Joint Variable Message Format
LDAP	Lightweight Directory Access Protocol
LDIF	LDAP Data Interchange Format
LSI	Lead Systems Integrator
LUT	Limited User Test
MCS	Mounted Combat System / Mobility Computer System/ Maneuver Control System
M&S	Modeling and Simulation
MATREX	Modeling Architecture for Technology and Research Experimentation
MILES	Multiple Integrated Laser Engagement System
MLRS	Multiple Launch Rocket System
MS&O	Modeling, Simulation and Operations
MSEL	Master Scenario Events List
MSO	Modeling and Simulation Office
MULE	Multi-function Utility/Logistics and Equipment Vehicle
MUSE	Multiple UAV Simulation Environment
N/A	Not Applicable
NLOS-LS	Non Line of Sight - Launch System
OBE	Overcome by Events
OneSAF	One Semi-Automated Forces
OOS	One Semi-Automated Force Objective System
ORD	Operational Requirements Document

Acronym List Pg 3 of 3

OS	Operating System
OSTRD	Objective System Test Requirements Document
OTC	Operational Test Command
PEO	Program Executive Office
PM	Program Manager
PMO	Program Management Office
PTRR	Pre Test Readiness Review
RDECOM	Research, Development, and Engineering Command
REDFOR	Red Force
(RICS)2	Reconfigurable Intelligent Instrumentation to Control, Collect, Simulate, & Stimulate
RPG	Rocket Propelled Grenades
RPWS	Role Player Work Station
RTI	Run Time Infrastructure
S2F	System of System Simulation Framework
SA	Situational Awareness
SO1	Spin Out 1
SoS	System of Systems
SUGV	Small Unmanned Ground Vehicle
TBD	To Be Determined
TCRS	Test Conduct and Reporting System
TEMP	Test and Evaluation Master Plan
TFT	Technical Field Test
TOEL	Time-Ordered Events List
TRADOC	Training and Doctrine Command
T-RAM	Technical Requirements Alignment Matrix
TRR	Test Readiness Review
T-UGS	Tactical Unattended Ground Sensor
USMTF	Unified Standard Military Text Format
U-UGS	Urban Unattended Ground Sensor
V&V	Verification and Validation
VMF	Variable Message Format
VV&A	Verification Validation and Accreditation
WSMR	White Sands Missile Range
XML	Extensible Markup Language